

## WHAT IS CLAIMED IS:

1. A digital signal transmission apparatus  
comprising:

5 a multiplexer having an output port, an input port  
for inputting an information bit-stream and an input port for  
inputting a placeholder bit-stream, for multiplexing the bit-  
streams inputted from the input ports to form a multiplexed  
bit-stream for output on the output port;

10 a data formatter for receiving the multiplexed bit-  
stream and for replacing bits of said placeholder bit-stream  
within the received multiplexed bit-stream with bits derived  
from said information bit-stream within said received  
multiplexed bit-stream to form a modified bit-stream;

15 an encoder for encoding the modified bit-stream to  
produce an encoded bit-stream; and

a transmitter for transmitting the encoded bit-  
stream.

2. The apparatus of claim 1, wherein the deriving  
20 creates a new bit, but retains any bit from which derivation  
has occurred.

3. The apparatus of claim 2, wherein said  
replacing comprises duplicating bits of said information bit-  
25 stream within said received multiplexed bit-stream to form

duplicate bits and substituting the duplicate bits to replace bits of said placeholder bit-stream within said received multiplexed bit-stream.

5           4.    The apparatus of claim 1, wherein the multiplexer is configured to multiplex an additional bit-stream in forming said multiplexed bit-stream, the data formatter is configured to bypass said replacing when operating on said additional bit-stream within said received  
10 multiplexed bit-stream to form said modified bit-stream, and the encoder is configured to process every bit of said modified bit-stream when operating on bits derived from said additional bit-stream and to process every other bit of said modified bit-stream when operating on bits derived from said  
15 information bit-stream.

          5.    The apparatus of claim 1, wherein the multiplexer is configured with an additional input port for inputting an additional bit-stream.

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          6.    The apparatus of claim 5, the multiplexer being configured to input a plurality of additional bit-streams, a plurality of information bit-streams and a plurality of placeholder bit-streams through their respective  
25 input ports for said multiplexing to form said multiplexed

bit-stream, each of the information bit-streams to be multiplexed by the multiplexer having an identical number of bits, each of the placeholder bit-streams to be multiplexed by the multiplexer having an identical number of bits, the  
5 multiplexer being configured to multiplex each of the information and placeholder bit-streams for their respective identical number of bits before selecting another bit-stream for multiplexing.

10           7.    The apparatus of claim 6, wherein said multiplexer is further configured to perform said multiplexing so as to select in succession, over a predetermined number of bit-streams, no more than three of said additional bit-streams.

15           8.    The apparatus of claim 6 wherein said multiplexer is further configured to perform said multiplexing so as to input in succession one or more of the additional bit-streams after each input of one of an  
20 information bit-stream and a placeholder bit-stream.

          9.    The apparatus of claim 8, wherein the plural bit-streams are identical in length, and the inputting of one of an information bit-stream and a placeholder bit-stream  
25 successively alternates, over at least most inputs of the one

information or placeholder bit-stream, between an information bit-stream and a placeholder bit-stream.

10. The apparatus of claim 1, wherein said  
5 replacing comprises removing selected bits from said information bit-stream within said received multiplexed bit-stream and substituting the removed bits to replace bits of said placeholder bit-stream within said received multiplexed bit-stream.

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11. A digital signal transmission method comprising the steps of:

          multiplexing an information bit-stream and a placeholder bit-stream to form a multiplexed bit-stream;  
15           receiving the multiplexed bit-stream;  
          replacing bits of said placeholder bit-stream within the received multiplexed bit-stream with bits derived from said information bit-stream within said received multiplexed bit-stream to form a modified bit-stream;  
20           encoding the modified bit-stream to produce an encoded bit-stream; and  
          transmitting the encoded bit-stream.

12. The method of claim 11, wherein the deriving creates a new bit, but retains any bit from which derivation has occurred.

5           13. The method of claim 12, wherein the replacing step comprises the steps of:

          duplicating bits of said information bit-stream within said received multiplexed bit-stream to form duplicate bits; and

10           substituting the duplicate bits to replace bits of said placeholder bit-stream within said received multiplexed bit-stream.

          14. The method of claim 11, further comprising the steps of:

          multiplexing an additional bit-stream in forming said multiplexed bit-stream; and

          bypassing said replacing step when operating on said additional bit-stream within said received multiplexed bit-stream to form said modified bit-stream;

          wherein said encoding step further comprises the steps of:

          processing every bit of said modified bit-stream when operating on bits derived from said additional bit-stream; and

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processing every other bit of said modified bit-stream when operating on bits derived from said information bit-stream.

5           15. The method of claim 11, wherein the multiplexing step further comprises multiplexing an additional bit-stream to form said multiplexed bit-stream.

10           16. The method of claim 15, wherein said multiplexing step comprises multiplexing a plurality of additional bit-streams, a plurality of information bit-streams, and a plurality of placeholder bit-streams to form said multiplexed bit-stream, each of said information bit-streams to be multiplexed by the multiplexer having an  
15 identical number of bits, each of said placeholder bit-streams to be multiplexed by the multiplexer having an identical number of bits, the multiplexing step being performed so as to multiplex each of the information and placeholder bit-streams for their respective identical number  
20 of bits before selecting another bit-stream for multiplexing.

          17. The method of claim 16, wherein said multiplexing step is performed so as to select in succession, over a predetermined number of bit-streams, no more than  
25 three of said additional bit-streams.

18. The method of claim 16 wherein the  
multiplexing step multiplexes so as to input in succession  
one or more of the additional bit-streams after each input of  
5 one of an information bit-stream and a placeholder bit-  
stream.

19. The method of claim 18, wherein the plural  
bit-streams are identical in length, and the inputting of one  
10 of an information bit-stream and a placeholder bit-stream  
successively alternates, over at least most inputs of the one  
information or placeholder bit-stream, between an information  
bit-stream and a placeholder bit-stream.

15 20. The method of claim 11, wherein the replacing  
step comprises the steps of:

selecting bits from said information bit-stream  
within said received multiplexed bit-stream;

removing the selected bits from said information  
20 bit-stream within said multiplexed bit-stream; and

substituting the removed bits to replace bits of  
said placeholder bit-stream within said received multiplexed  
bit-stream.